

IN THE CLAIMS:

The text of all pending claims are set forth below. Cancelled and withdrawn claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~striketrough~~. The status of each claim is indicated with one of (original), (currently amended), (previously amended), (cancelled), (withdrawn), (new), (previously added), (reinstated - formerly claim #), (previously reinstated), (re-presented - formerly dependent claim #) or, (previously re-presented).

Please AMEND the claims in accordance with the following:

1. (CURRENTLY AMENDED) A robot system having an image processing function for determining orientation, or orientation and position of a robot operation on an object of detection among a plurality of objects, the system comprising:

a robot;

a first image capturing device;

a memory storing reference models, each ~~created based on~~ comprising an image of a reference object captured by said image capturing device in a different direction, and for each reference model storing information of the capturing direction of its associated image and information of an orientation of the robot with respect to the reference object, said reference object being ~~the object of detection~~ one of the plurality of objects or having a shape substantially identical to ~~that of the object of detection~~ one of the plurality of objects; and

a processor to perform matching processing on the reference model images and an a working image of the object of detection-plurality of objects (captured by said first image capturing device) ~~using said reference models to select an image of one of the reference models whose image of the reference object matched with~~ that matches the image of the object of detection in the working image, and to determine the orientation, or the orientation and position of the robot operation to be performed on the object of detection, the determining based on the selected image of the reference object, based on said one reference model and the information of its associated capturing direction, and based on the information of the orientation of the robot with respect to the reference object that is associated with said one reference model.

2. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 1, wherein said reference models are obtained from a part of the image data of the reference object.

3. (ORIGINAL) A robot system having an image processing function according to claim 1, wherein said reference models are obtained by processing the image data of the reference object.

4. (ORIGINAL) A robot system having an image processing function according to claim 1, wherein said first image capturing device comprises a camera for capturing two-dimensional image data.

5. (ORIGINAL) A robot system having an image processing function according to claim 4, wherein said image data of the reference object are captured by said camera from a predetermined distance.

6. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 1, further comprising:
a second image capturing device; wherein
said robot situates said second image data capturing device to have said determined orientation or to have said determined orientation and said determined position with respect to the object, and wherein
said processor processes second image data captured by said second image capturing device to detect position and/or posture of the object with respect to said second image data capturing device.

7. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 1 further comprising:
a second image capturing device for obtaining three-dimensional position; wherein
said robot situates said second image data capturing device to have said determined orientation or to have said determined orientation and said determined position with respect to the object, so that said second image data capturing device is directed to a characterizing portion of the object; and wherein
said processor detects three-dimensional position and/or posture of the object based

on three-dimensional position of said characterizing portion obtained by said second image capturing device.

8. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 1~~claim 6, wherein said first image data capturing device is used as said second image data capturing device.

9. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 1~~claim 6, wherein said second image capturing device comprises a three-dimensional visual sensor of spot-light scanning type capable of measuring distance between the sensor and an object.

10. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 1~~claim 6, wherein said second image data capturing device comprises a structured-light unit for irradiating a structured light on an object and capturing an image of the object including the irradiated light on the object.

11. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 7, wherein said robot operation is an operation of picking up at least one object from a plurality of objects overlapped with each other.

12. (CURRENTLY AMENDED) A robot system having an image processing function for determining orientation, or orientation and position of a robot operation on an object of detection among a plurality of objects of plural kinds, the system comprising:
a robot;
a first image capturing device;
a memory storing reference models, each ~~created based on~~comprising images of each of different kinds of reference objects captured by said first image capturing device, and storing indicia of the kinds respectively associated with said reference models, and information of a different orientation of the robot with respect to each of the different images of the reference object of each kind, each of said ~~kind of~~ reference objects ~~potentially being one of the kinds of the plurality of objects the object of detection or an object or~~ having a shape substantially identical to thereto ~~that of the object of detection~~; and

a processor to perform matching processing on ~~an~~ the reference model images and a working image of the ~~object of detection plurality of objects of plural kinds~~ (captured by said first image capturing device) ~~using said reference models~~ to select an image of one of said kinds of the reference models that matches the object of detection in the working image, and to determine the orientation, or the orientation and position of the robot operation to be performed on the object of detection, the determining based on the selected image ~~of the reference object~~, based on said one reference model, based on the indicia of the kind associated with said one reference model and the information of the orientation of the robot with respect to the reference object associated with said one reference model of said one kind.

13. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 12, wherein said reference models are obtained from a part of the image data of the reference object.

14. (ORIGINAL) A robot system having an image processing function according to claim 12, wherein said reference models are obtained by processing the image data of the reference object.

15. (ORIGINAL) A robot system having an image processing function according to claim 12, wherein said first image capturing device comprises a camera for capturing two-dimensional image data.

16. (ORIGINAL) A robot system having an image processing function according to claim 15, wherein said image data of the reference object are captured by said camera from a predetermined distance.

17. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 12, further comprising a second image capturing device, wherein said robot situates said second image data capturing device to have said determined orientation or to have said determined orientation and said determined position with respect to the object, and wherein

said processor processes second image data captured by said second image capturing device to detect position and/or posture of the object with respect to said second

image data capturing device.

18. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 12, further comprising:

a second image capturing device for obtaining three-dimensional position; wherein said robot situates said second image data capturing device to have said determined orientation or to have said determined orientation and said determined position with respect to the object, so that said second image data capturing device is directed to a characterizing portion of the object; and wherein

said processor detects three-dimensional position and/or posture of the object based on three-dimensional position of said characterizing portion obtained by said second image capturing device.

19. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 12~~claim 17, wherein said first image data capturing device is used as said second image data capturing device.

20. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 12~~claim 17, wherein said second image capturing device comprises a three-dimensional visual sensor of spot-light scanning type capable of measuring distance between the sensor and an object.

21. (CURRENTLY AMENDED) A robot system having an image processing function according to ~~claim 12~~claim 17, wherein said second image data capturing device comprises a structured-light unit for irradiating a structured light on an object and capturing an image of the object including the irradiated light on the object.

22. (PREVIOUSLY AMENDED) A robot system having an image processing function according to claim 18, wherein said robot operation is an operation of picking up at least one object from a plurality of objects overlapped with each other.

23. (WITHDRAWN, CURRENTLY AMENDED) A method for automatically determining an arrangement of a workpiece relative to a robot, ~~the robot comprising an imaging device affixed to an arm,~~ the method comprising:

storing reference images of the workpiece or an object so shaped (workpiece/object) and reference arrangement information indicating arrangements of the robot and workpiece/object relative to each other when the images were captured;

from a known arrangement of the robot, capturing a working image of the workpiece among a plurality of randomly arranged workpieces with ~~the an~~ imaging device;

finding one of the reference images that has a closest match to the workpiece in the working image; and

determining a known arrangement of the robot relative to the workpiece based on information indicating the known arrangement of the robot, and based on the reference arrangement information corresponding to the found reference image.

24. (WITHDRAWN) A method according to claim 23, wherein reference images and reference arrangement information is obtained for workpieces/objects of different shapes, and wherein the finding comprises first determining that a reference image of one of the different shapes matches the working image of the workpiece, and then finding one reference image of the shape that best matches the working image.

25. (WITHDRAWN) A method according to claim 23, wherein the robot is used to capture the reference images, and wherein the reference arrangement information represents arrangements of the robot when capturing the reference images.

26. (WITHDRAWN) A method according to claim 23, wherein a second imaging device is affixed to the arm and is used to determine additional arrangement information used to determine the known arrangement of the robot relative to the workpiece.

27. (NEW) A robot system having an image processing function according to claim 7, wherein said first image data capturing device is used as said second image data capturing device.

28. (NEW) A robot system having an image processing function according to claim 7, wherein said second image capturing device comprises a three-dimensional visual sensor of spot-light scanning type capable of measuring distance between the sensor and an object.

29. (NEW) A robot system having an image processing function according to claim 7, wherein said second image data capturing device comprises a structured-light unit for irradiating a structured light on an object and capturing an image of the object including the irradiated light on the object.

30. (NEW) A robot system having an image processing function according to claim 18, wherein said first image data capturing device is used as said second image data capturing device.

31. (NEW) A robot system having an image processing function according to claim 18, wherein said second image capturing device comprises a three-dimensional visual sensor of spot-light scanning type capable of measuring distance between the sensor and an object.

32. (NEW) A robot system having an image processing function according to claim 18, wherein said second image data capturing device comprises a structured-light unit for irradiating a structured light on an object and capturing an image of the object including the irradiated light on the object.
